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MONTHLY WEIGHT AND BALANCE REPORT FOR THE APOLLO SPACECRAFT

CONTRACT NAS 9-150

(U)

1 SEPTEMBER 1963

4.5.4.5

Prepared by

Weight Control

CLASSIFICATION CHANGE

To UNCLASSIFIED

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NORTH AMERICAN AVIATION, INC.

SPACE and INFORMATION SYSTEMS DIVISION

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INTRODUCTION

The September report reflects a spacecraft weight increase of 270 pounds at injection and 495 pounds at the injected spacecraft condition less service module propellant. Although the injected spacecraft weight less propellant was increased as noted, the propellant weight was decreased 225 pounds by a more accurate determination of propellant usage as a function of spacecraft weight. A further propellant weight decrease is anticipated with additional refinement. The current injected weight of 84,365 pounds is within the design goal of 85,000 pounds and is based on the Service Module loaded with sufficient propellant at a specific impulse of 313.0 sec. to provide 10 per cent $\triangle V$ margin, and LEM emergency chase maneuver. This is based on a LEM weight, including crew, of 25,000 pounds.

The Command Module weight included in this report has exceeded the proposed control weight of 9,500 pounds. This weight is based on the analysis of released drawings for Airframe Number 011. A weight reduction program is being initiated to incorporate design refinements at an expedient change point.

The major changes in the Command Module were due to the heat shield structure design for thermal and cold soak conditions, revised controls and displays, and the incorporation of the RCS propellant dumping provisions to eliminate a potential explosive hazard at earth impact.

The major changes in the Service Module were due to a reduction of external insulation for the RCS engine plumes and a design refinement in the EPS and ECS space radiators.

The Launch Escape System ballast was increased consistent with the combined Command Module and Launch Escape System balance requirement.

The Adapter weight has been increased consistent with recent LEM configurations.

The potential changes have been revised to include the weight reduction associated with an eight day duration in lieu of a 14-day duration for the LOR Mission while retaining alternate mission capabilities for a 14-day duration. A reduction in scientific equipment to 80 pounds for the LOR Mission while retaining capabilities for 250 pound loading on alternate missions is also included with the potential changes.

The Weight History Section has been revised to include the present terminology defined in NASA TWX SCE 6-470 T39/63-677. The target weight designation has been replaced by design goal.

The earth orbital mission weight summary reflects a two stage booster-to-orbit injection without the use of Service Module propulsion and is based on a complete Service Module loaded with 2,335 pounds of propellant.

APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.2)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9650	1043.0	-0.4	7.8	4393	3812	3643
SERVICE MODULE - Less Propellant	9680	907.6	0.8	-0.6	6285	10477	10296
TOTAL - Less Propellant	19330	975.2	0.2	3.6	10752	33485	33063
PROPELLANT - S/M**	37175	905.7	5.7	-2.5	19300	30100	26100
TOTAL - With Propellant	56505	929.5	3.8	-0.4	30237	66944	72503
LUNAR EXCURSION MODULE	24460	623.0	0.0	0.0	13616	12776	13247
ADAPTER - LEM - C-5	3400	642.7	0.0	0.0	8372	12273	12273
TOTAL - Injected	84365	829.1	2.6	-0.3	52285	464626	470714
LAUNCH ESCAPE SYSTEM	6650	1295.7	0.0	-0.1	251	9441	9443
TOTAL - Spacecraft Launch	91015	863.2	2.4	-0.3	52544	763783	769881

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

**The propellant weight of 37175 pounds provides approximately 10% ΔV margin, and is determined from an estimated time line analysis. The propellant weight is based on a specific impulse of 313.0.

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APOLLO EARTH ORBIT MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.^{2})		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9650	1043.0	-0.4	7.8	4393	3812	3643
SERVICE MODULE - Less Propellant	9680	907.6	0.8	-0.6	6285	10477	10296
TOTAL - Less Propellant	19330	975.2	0.2	3.6	10752	33485	33063
PROPELLANT - S/M**	2335	848.5	27.0	-11.7	800	450	600
TOTAL - With Propellant	21665	961.5	3.1	1.9	11981	41258	41204
ADAPTER - C-1	830	779.7	0.0	0.0	1029	753	753
TOTAL - Injected	22495	954.8	3.0	1.9	13012	47717	47664
LAUNCH ESCAPE SYSTEM	6650	1295.7	0.0	-0.1	251	9441	9443
TOTAL - Spacecraft Launch	29145	1032.6	2.3	1.4	13276	185886	185840

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

**The earth orbital weights are based on a complete service module and includes 2335 pounds of propellant for an orbital altitude of about 100 nautical miles with a payload launch azimuth of 72°.

APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.^{2})		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9650	1043.0	-0.4	7.8	4393	3812	3643
LAUNCH ESCAPE SYSTEM	6650	1295.7	0.0	-0.1	251	9441	9443
TOTAL - Launch Abort	16300	1146.1	-0.2	4.6	4697	67570	67350
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3210	1296.5	0.0	0.0	-69	-1330	-1330
TOTAL - LES Burnout	13090	1109.2	-0.3	5.7	4609	46705	46502

NOTE: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LUNAR ORBIT RENDEZVOUS MISSION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Izy
EARTH LAUNCH	9650	1043.0	-0.4	7.8	4393	3812	3643	30	-189	-42
ADJUSTMENTS (NET) Boost & Mission Coolants Food & Water Consumption Mission Waste Pickup Fuel Cell Water Pickup	+67									
PRIOR TO ENTRY	9717	1042.6	-0.3	8.0	4441	3854	3678	42	-211	-36
Less: Propellant	-258	1022.6	-6.2	56.6						
Ablator Burnoff	-223	1019.7	0.0	11.2						
Entry Coolant	-6	1022.6	-63.4	-16.4						
Forward Heat Shield	-364	1100.0	0.0	1.9						
Drogue Chute	-25	1090.0	11.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	8841	1041.3	-0.1	6.9	4009	3220	3135	32	-121	-36
Less: Main Chutes (3)	-440	1089.9	0.3	6.7						
LANDING	8401	1038.8	-0.2	6.9	3964	2965	2862	29	-121	-36

NOTE: Mass inertia data is shown for accumulative totals only.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

HIGH ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Izy
EARTH LAUNCH	9650	1043.0	-0.4	7.8	4393	3812	3643	30	-189	-42
Less: Boost Coolants	-14	1019.4	-51.0	-21.0						
PRIOR TO ENTRY	9636	1043.0	-0.3	7.8	4382	3808	3633	26	-191	-46
Less: Propellant	-258	1022.6	-6.2	56.6						
Ablator Burnoff	-56	1019.7	0.0	11.2						
Entry Coolant	-6	1022.6	-63.4	-16.4						
Forward Heat Shield	-364	1100.0	0.0	1.9						
Drogue Chute	-25	1090.0	11.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	8927	1041.3	-0.2	6.8	4064	3284	3197	16	-105	-46
Less: Main Chutes (3)	-440	1089.9	0.3	6.7						
Landing	8487	1038.8	-0.2	6.8	4019	3030	2923	13	-105	-46

NOTE: Mass inertia data is shown for accumulative totals only.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Izy
EARTH LAUNCH	9650	1043.0	-0.4	7.8	4393	3812	3643	30	-189	-42
Less: Propellant	-258	1022.6	-6.2	56.6						
Forward Heat Shield	-375	1097.8	-0.3	3.2						
Drogue Chute	-25	1090.0	11.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	8992	1041.2	-0.3	6.7	4118	3337	3257	22	-110	-40
Less: Main Chutes (3)	-440	1089.9	0.3	6.7						
LANDING	8552	1038.7	-0.3	6.7	4073	3081	2983	19	-110	-40

NOTE: Mass inertia data is shown for accumulative totals only.

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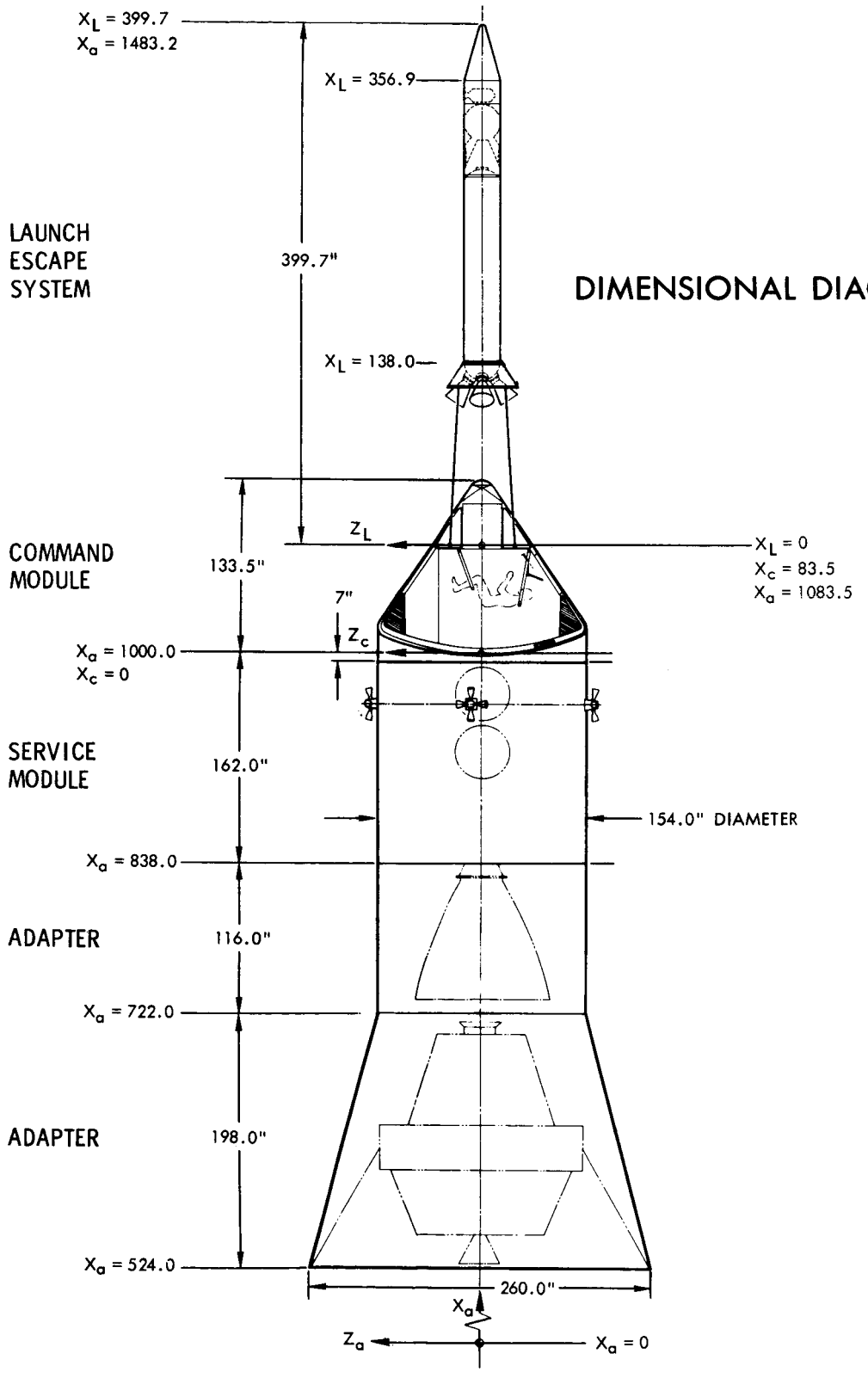
DIMENSIONAL DIAGRAM



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SPACECRAFT

WEIGHT STATUS SUMMARY

ITEM	PREVIOUS STATUS 8-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 9-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
COMMAND MODULE	9400	+250	9650	59	39	2
SERVICE MODULE	47125	-320	46805	5	95	-
LES	6600	+50	6650	34	58	8
ADAPTER	3110	+290	3400	100		
TOTAL	66235	+270	66505	20	79	1

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COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 8-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 9-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	(4481)	(+86)	(4567)			
Structure - Less Ablator	3204	+86	3290	33	67	
Ablation Material	1277		1277	100		
Crew Systems	320	+11	331	95	5	
Communications	384	-16	368	100		
Instrumentation	193		193	100		
Controls and Displays	170	+116	286	100		
Guidance and Navigation	478	-53	425	100		
Stabilization and Control	209	+28	237	100		
Reaction Control	290	+38	328	84	16	
Electrical Power	427	+4	431	96	4	
Environmental Control	292		292	70	30	
Earth Landing	567	+31	598	8	64	25
WEIGHT EMPTY	7811	+245	8056	64	34	2
Crew (3), (50, 70, 90 percentile)	528		528		100	
Crew System Equipment	299	-6	293	93	3	4
Food and Containers	90		90	100		
Reaction Control Propellant	259	+11	270		100	
Environmental Control Chemicals	163		163		100	
Scientific Payload	250		250	100		
GROSS WEIGHT	9400	+250	9650	59	39	2

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COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

STRUCTURE		(+86.0)
Basic Body Structure Forward Section		+9.0
Decrease gussets due to redesign to facilitate two point parachute attachment.	-2.0	
Add beams and attach fittings to protect pitch motor from main parachute riser impact loads resulting from two point parachute attachment.	+11.0	
Basic Body Structure Center Section		+1.0
Increase crew hatch frame due to deletion of cutout in lower frame to facilitate manufacturing.	+1.0	
Increase crew hatch due to the addition of handles not previously included.	+1.0	
Add one additional coaxial feed through fitting and liquid waste overboard line fitting based on current design requirements.	+3.0	
Decrease side and rendezvous window mounting provisions due to revised calculations.	-3.0	
Decrease mounting seal around telescope and sextant due to revised calculations.	-1.0	
Increase secondary structure due to evaluation of current drawings reflecting the new support structure associated with the change in equipment location to improve the center of gravity location.		+18.0
Heat Shield Substructure Forward Section		+7.0
Increase thruster fitting due to the requirement for tension loads in addition to compression loads as a solution to the gap problem.	+3.0	
Increase cross sectional area of the aft ring in the forward section due to a reduction in the heat treat allowable from 155,000 psi to 135,000 psi.	+4.0	

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COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

STRUCTURE (CONTINUED)		
Heat Shield Substructure Center Section		+30.0
Decrease structure around window based on design refinements of welded structure.	-2.0	
Increase inner structure to outer structure attach due to replacing "I" section with a slip stringer consisting of a tee and clevis to solve the unequal expansion problem during cold soak.	+30.0	
Decrease side window due to calculations of current drawings reflecting a reduction in area over original estimated sizes.	-7.0	
Increase panels locally due to addition of ports for pressure vent and steam vent, also for housing scimitar antenna.	+9.0	
Increase cross sectional area of the forward ring due to a reduction in the heat treat allowable from 155,000 psi to 135,000 psi.	+3.0	
Increase frames in the aft compartments due to redesign to truss the excessive loads that are being transmitted directly into the basic structure.	+2.0	
Decrease panel weight due to installing the umbilical disconnect directly through the panel in lieu of providing a separate door installation.	-3.0	
Decrease hatch window frame due to calculations of current released drawings in lieu of estimates.	-2.0	
Heat Shield Substructure Aft Section		+23.0
Increase face sheets in local area due to the addition of an oxidizer vent valve as part of the fuel dumping system.	+3.0	
Increase body to heat shield attachments due to the requirement to provide a gap between the bolt head and the fiberglas insulating washer for slippage during thermal expansion.	+20.0	

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COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

STRUCTURE (CONTINUED)		
Separation Provision		-2.0
Decrease separation provision due to calculations of current drawings of the separation nuts.	-2.0	
CREW SYSTEMS		(+11.0)
Increase waste management due to calculations of released plumbing drawings, installation hardware and vendor weights as follows:		+11.0
Urine Disposal Lock, Vendor Weight	-.3	
Bacteria Control Unit, Vendor Weight	-.5	
Vacuum Cleaner Head and Hose, Vendor Weight	+1.0	
Selector Valve, Vendor Weight	+1.7	
Backup Valve, Vendor Weight	+.1	
Check Valves (2) Added	+.6	
Plumbing, Steel Lines in lieu of aluminum	+6.7	
Plumbing installation provisions	+1.7	
COMMUNICATIONS		(-16.0)
Decrease C-band antennas due to incorporation of current specification weights.		-1.4
Decrease multiplexer due to deletion of filter per Collins weight report.		-0.6
Decrease up-data link due to revised vendor estimate.		-10.0
Decrease scimitar antennas due to change in design combining four into two.		-4.0
CONTROLS & DISPLAYS		(+116.0)
Increase entry monitoring indicator due to incorporating current vendor weights.		+7.0
Add mounting panels for controls and displays to provide more usable volume behind display panels.		+14.1
Transfer crew area manual controls from stabilization and control to controls and displays.		+15.0

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COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

CONTROLS & DISPLAYS (CONTINUED)	
Increase manual controls due to adding electrical control cables to the SCS hand controls per Minneapolis-Honeywell status.	+9.6
Transfer G & N controls and displays from Guidance and Navigation to Control and Displays.	+49.2
Add caution and warning detector and spares required to process and initiate warning lights in an emergency condition.	+16.5
Add lighting control panel to control lights that illuminate the lower equipment bay.	+1.2
Increase controls and displays due to revised estimate of current indicator requirements.	+3.4
GUIDANCE & NAVIGATION	(-53.0)
Decrease computer per MIT status reflecting the redesign G & N computer.	-23.0
Increase MIT cabling due to redesigned computer per MIT status.	+10.0
Increase spares due to redesigned computer per MIT status.	+10.0
Decrease bellows and adapter due to actual weight of components per MIT status.	-1.3
Transfer G & N displays to controls and displays.	-49.2
Increase NAA cabling due to revised estimate.	+0.5
STABILIZATION & CONTROL	(+28.0)
Increase SCS packages per current data from Minneaplis-Honeywell reflecting the following:	+41.0
Rate Gyro Package +0.6	
Body Mounted Gyro Package +1.6	

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COMMAND MODULE

CURRENT WEIGHT EMPTY CHANGES

STABILIZATION & CONTROL (CONTINUED)	
Electronic Control Package - Pitch	+7.8
Electronic Control Package - Roll	+5.6
Electronic Control Package - Yaw	+7.5
Electronic Control Package - Auxiliary	+3.9
Display/BMAG ECA Package	+14.7
Spare Gyro - Rate	-0.3
Transfer manual control to Controls and Displays.	-15.0
Increase electrical provisions due to adding an SCS power junction box.	+2.0
REACTION CONTROL	(+38.0)
Increase expulsion tank due to increasing propellant tank volume from 258 pounds to 269 pounds.	+1.0
Add reaction control propellant disposal system to dispose of the Command Module propellant prior to impact for elimination of potential explosion.	+37.0
ELECTRICAL POWER	(+4.0)
Increase inverters based on current status from Westinghouse.	+3.0
Increase forward bulkhead feed-thru due to calculations based on a steel receptacle.	+1.0
EARTH LANDING SYSTEM	(+31.0)
Increase pack assembly for main chute due to the addition of handle extensions to each main parachute deployment bag per Northrop status.	+3.0
Increase retention assembly due to the requirement for additional retention straps per Northrop status.	+3.7
Increase main cluster harness assembly due to adding a metal link because of stitching requirements per Northrop status.	+23.0
Increase tubing wall thickness due to current design requirements for the forward heat shield ejection system.	+1.3
TOTAL COMMAND MODULE CURRENT WEIGHT EMPTY CHANGES	+245.0

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COMMAND MODULE

CURRENT USEFUL LOAD CHANGES

CREW SYSTEMS		(-6.0)
Increase personal radiation dosimeters per NASA Crew System Meeting Number 19, Action Item Number 6.		+9.8
Decrease portable life support system due to the following:		-17.0
Increase PLSS per Hamilton Standard status.	+36.0	
Delete initial charge water for coolant which is now carried in the potable water tank..	-5.0	
Delete one PLSS consistent with requrements for LOR mission.	-48.0	
Increase portable light assembly due to refined specification requirements.		+2.0
Decrease personal hygiene equipment due to a reduction in the quantity of dentifrice required.		-0.2
Decrease waste management based on current requirements.		-0.6
REACTION CONTROL		(+11.0)
Increase usable propellants by ten pounds and residuals by one pound to meet the current Rocketdyne engine performance.		+11.0
TOTAL COMMAND MODULE CURRENT USEFUL LOAD CHANGES		+5.0

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SERVICE MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 8-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 9-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	2290	-25	2265	17	73	10
Electronics	177		177	100		
Reaction Control	590	-10	580	61	39	
Electrical Power	1332	-13	1319	15	83	2
Environmental Control	99	-12	87	23	73	4
Propulsion System	(3007)	(+15)	(3022)			
Engine Installation	690	+25	715	82	18	
Propulsion System	2317	-10	2307	15	85	
WEIGHT EMPTY	7495	-45	7450	28	69	3
RCS Propellant	838		838		100	
Electrical Power Supercritical Fluids	503		503		100	
Environmental Control Supercritical Fluids	208		208		100	
Main Propulsion Helium	99		99		100	
Main Propellant Residuals	(582)		(582)		100	
Trapped - System	225		225			
Trapped - Engine	67		67			
Mixture Ratio Tolerance	100		100			
Loading Tolerance	190		190			
BURNOUT WEIGHT	9725	-45	9680	22	76	2
Main Propellant	37400	-275	37125		100	
GROSS WEIGHT	47125	-320	46805	5	95	-

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SERVICE MODULE

CURRENT WEIGHT EMPTY CHANGES

STRUCTURES		(-25.0)
Transfer closeout between Service Module structure and SPS engine from aft heat shield to Main Propulsion System.		-25.0
REACTION CONTROL SYSTEM		(-10.0)
Oxidizer System		+6.2
Add quantity gaging system equipment.	+10.0	
Add supports for quantity gaging system - electrical.	+0.2	
Delete flowmeters - not required with quantity gaging system.	-4.0	
Fuel System		+6.2
Add quantity gaging system - equipment.	+10.0	
Add supports for quantity gaging system - electrical.	+0.2	
Delete flowmeters - not required with quantity gaging system.	-4.0	
Engine System		-24.6
Transfer weight from electrical provisions for the 2 coil valve configuration - MCR A95.	+5.4	
Reduce Service Module external insulation for the RCS engine plumes to agree with released drawing configuration.	-30.0	
Electrical Provisions		+2.2
Transfer weight to engine section for 2 coil valve configuration - MCR A95.	-5.4	
Add wiring for propellant quantity gaging system.	+7.6	

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SERVICE MODULE

CURRENT WEIGHT EMPTY CHANGES

ELECTRICAL POWER SYSTEM		(-13.0)
Fuel cell power pack (P & W)		-11.2
Redesign accessory section mounting structure and transfer weight	-20.7	
Increase cell weights based on average of actual weights.	+8.7	
Increase KOH weight based on average of actual weights.	+7.4	
Add outer screen to preserve shape and utility of insulation.	+1.2	
Refine fuel regenerator design.	-3.9	
Refine coolant regenerator design.	-4.2	
Increase miscellaneous provisions.	+0.3	
Increase fuel cell hydrogen system per Beech status.		+1.2
Increase fuel cell oxygen system per Beech status.		+1.0
Increase space radiator chem-mill area.		-13.5
Increase power distibution box due to additional bus bars, wiring, fuses and increase in motor switch weight.		+7.1
Revise estimate of electrical common utility provisions.		+2.4
ENVIRONMENTAL CONTROL SYSTEM		(-12.0)
Water-Glycol Circuit		-11.9
Increase plumbing due to additional fittings, etc.	+0.3	
Decrease area in space radiator cores.	-12.2	
Decrease common supports per revised estimate.		-0.1

[redacted]

[redacted]

SERVICE MODULE

CURRENT WEIGHT EMPTY CHANGES

MAIN PROPULSION		(+15.0)
Oxidizer System		-12.0
Decrease quantity indication (-9.5 pounds) and increase mixture ratio control system (+2.0 pounds) to agree with the Procurement Specification.	-7.5	
Decrease supports per calculation of released drawings.	-4.5	
Fuel System		-14.0
Decrease quantity indication system to agree with the Procurement Specification.	-9.5	
Decrease supports per calculation of released drawings.	-4.5	
Engine System		+25.0
Transfer the closeout between the Service Module structure and SPS engine from Structures.	+25.0	
Electrical Provisions		+16.0
Increase wire per revision of the Procurement Specifications for the quantity gaging and mixture ratio control systems, deleting the wire from vendor-furnished and adding to NAA/SID furnished.	+16.0	
TOTAL SERVICE MODULE CURRENT WEIGHT EMPTY CHANGES		-45.0

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LAUNCH ESCAPE SYSTEM

WEIGHT STATUS

ITEM	PREVIOUS STATUS 8-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 9-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	1011		1011		100	
Electrical System	41		41	100		
Propulsion System						
Main Thrust	4764		4764	40	60	
Jettison	434		434			100
Jettison Motor Skirt	92		92			100
Pitch Control	55		55	60	40	
LES - NO BALLAST	6397		6397	31	61	8
BALLAST	203	+50	253	100		
TOTAL L.E.S.	6600	+50	6650	34	54	8

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LAUNCH ESCAPE SYSTEM

CURRENT WEIGHT CHANGES

BALLAST	(+50)
Increase ballast consistent with combined Command Module and Launch Escape System balance requirements.	(+50)
TOTAL LAUNCH ESCAPE SYSTEM CURRENT WEIGHT CHANGES	+50

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ADAPTER

WEIGHT STATUS

ITEM	PREVIOUS STATUS 8-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 9-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	2892	+178	3070			
Electrical	76	+4	80			
Separation System	142	+108	250			
TOTAL ADAPTER	3110	+290	3400	100		

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CURRENT WEIGHT CHANGE

SATURN V ADAPTER

Increase the added length and structure due to revised configuration to be compatible with the existing LEM configuration.	+290

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WEIGHT HISTORY COMMENTS

LAUNCH ESCAPE SYSTEM

The design goal established for the LES is 6,300 pounds, excluding ballast. This weight was based on the September 1962 status weight of 6,600 pounds, including the necessary ballast to provide currently determined aerodynamic stability to prevent tumbling.

The original design goal of 5,900 pounds, as reported in the June status, SID 62-99-5, was based on an attitude controlled configuration. The current configuration weight includes a pitch motor and ballast not included in the original target weight.

COMMAND MODULE

The adjusted design goal established for the Command Module is 8,702 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes.

The original design goal weight of 8,340 pounds, as reported in the June status, SID 62-99-5, did not include the proposed increases nor the Category I reductions presented in the July briefing and incorporated in the July Status Report.

SERVICE MODULE

The adjusted design goal established for the Service Module less usable propellant is 11,000 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes. This configuration is sized for 45,000 pounds usable propellant for the 25,000 pound LEM.

The original design goal weight of 8,595 for the burnout condition was based on a lunar configuration sized for 31,000 pounds usable propellant.

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WEIGHT HISTROY

COMMAND MODULE

	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 9-1-63
Structure	3824		3824
Crew Systems	530		530
Communication	330	+33	363
Instrumentation	173	+7	180
Controls & Displays	261		261
Guidance & Navigation	261	+164	425
Stabilization & Control	181		181
Reaction Control	195		195
Electrical Power	390	+10	400
Environmental Control	235	-5	230
Earth Landing	610		610
WEIGHT EMPTY	6990	+209	7199
Crew	528		528
Suits & Personal Equipment	304	-7	297
Food & Containers	90		90
Reaction Control Propellant	210		210
Environmental Control Fluids	128		128
Scientific Payload	250		250
GROSS WEIGHT	8500	+202	8702

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COMMAND MODULE WEIGHT HISTORY

WEIGHT EMPTY AUTHORIZED CHANGES

COMMUNICATIONS	(+33)
Add a spacecraft up-data link for the purpose of providing current GOSS data within the spacecraft for display and comparison with the on-board computed data. (CCA No. 54).	+35
Change the present two speed data storage to a three speed machine to provide fast dump of data. (CCA No. 59)	-2
INSTRUMENTATION	(+7)
Increase the PCM output bit rate from 31,000 to 51,200 bit/sec. This change was originally considered to have a negligible weight affect but has henceforth been reported by Collins to cause a seven pound increase. (CCA No. 44)	+7
GUIDANCE & NAVIGATION	(+164)
Increase the Guidance and Navigation per recent weight report from M.I.T. Since NAA does not have weight control responsibility for the M.I.T. design, the weight changes in their Weight and Balance Report will be considered as authorized changes.	+164
ELECTRICAL POWER	(+10)
Add two batteries to provide a source of power, separate from the primary D.C. power, to initiate pyrotechnic devices. (CCA No. 28)	+10
ENVIRONMENTAL CONTROL	(-5)
Add a CO_2 sensor to the ECS as a part of the ECS operational instrumentation. (CCA No. 43)	+2
Add a surge tank to ECS and delete entry oxygen supply to provide early mission emergency gas flows. (CCA No. 52)	-7
TOTAL COMMAND MODULE WEIGHT EMPTY CHANGES	+209

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COMMAND MODULE WEIGHT HISTORY

USEFUL LOAD AUTHORIZED CHANGES

SUITS & PERSONAL EQUIPMENT		(-7)
Change the following GFE (NASA) responsibility items:		
Increase personal radiation dosimeters per NASA Crew Systems Meeting Number 19, Action Item Number 6.	+10	
Increase PLSS per Hamilton Standard status.	+36	
Delete initial charge water for coolant, from PLSS, as this item is now carried in the potable water tank.	-5	
Delete one PLSS consistent with requirements for LOR mission.	-48	
TOTAL COMMAND MODULE USEFUL LOAD CHANGES		-7

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WEIGHT HISTORY

SERVICE MODULE

	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 9-1-63
Structure	3203		3203
Electronics	145		145
Reaction Control	737		737
Electrical Power	1203		1203
Environmental Control	250		250
Propulsion System			
Engine Installation	606		606
Propellant System	2456		2456
WEIGHT EMPTY	8600		8600
Usable RCS Propellant	611		611
Usable Fuel Cell Reactants	479		479
Environmental Control Fluids	193		193
Main Propulsion Helium	139		139
Main Prop. Residuals	900		900
Unusable RCS Propellant	61		61
Unusable Fuel Cell Reactants	17		17
BURNOUT WEIGHT	11000		11000
Main Propellant	45000		45000
GROSS WEIGHT	56000		56000

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

STRUCTURE	(-94)
Addition of crushable HCB core installation in aft compartment.	25
Incorporation of oxidizer dump in aft heat shield.	3
Reduction of heat shield window glass thickness from 0.70 to 0.55 inches.	-10
Replacement of present strake - antenna configuration with scimitar antennas on +Z and -Z axis.	-23
Incorporation of pressure vent in aft compartment.	25
Addition of second drogue mortar support and redesign of riser attachment to accommodate higher loads.	6
Main parachute yoke installation study.	-20
Refinement of structure beyond AFRM 011.	-100
CREW SYSTEMS	(-137)
Remove primary O_2 from remaining PLSS back packs.	-1
Remove food from survival kits.	-3
Change in crew and metabolic criteria based on astronaut data and new NASA metabolic rates.	
Crew	-49
Food and Containers	-12
Change crew couch pads from insolite to trilok.	-5
Replace three survival kits with one collective kit.	-10
Reduce radiation dosimeters	-10
Reduce or eliminate portable light.	-3

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

CREW SYSTEMS (CONTINUED)	
Decrease mission duration from 14 days to 8 days:	
Food and Containers	-38
Chemical Disinfectant	-2
Personal Hygiene Equipment	-4
COMMUNICATION & INSTRUMENTATION	(+26)
Add electrical provisions for test instrumentation to monitor C-1 and C-5 booster per NASA.	16
Add provisions for flight qualification PCM.	10
REACTION CONTROL SYSTEM	(+2)
Propellant tank increase.	2
ELECTRICAL POWER SYSTEM	(+16)
Addition of power supply for PLSS.	2
Increase battery weight per Eagle-Picher 5 August 1963 status.	14
ENVIRONMENTAL CONTROL SYSTEM	(-135)
Delete regenerative heat exchanger.	-7
Addition of N_2 purge system for unpressurized compartments.	3
Relocate suit umbilical control connections.	-8
Delete Freon system and associated items.	-13
Reduce lithium hydroxide and containers per change in Crew and Metabolic criteria based on astronaut data and new NASA metabolic rates.	-24
Reduce quantity requirements of lithium hydroxide due to mission duration decrease from 14 days to 8 days.	-55
Change in 78g requirements to comply with structure criteria (AiResearch items).	-8

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM (CONTINUED)	
Investment castings in lieu of precision sand castings on suit compressor and glycol pump.	-5
Delete suit circuit air return check valve.	-1
Delete two lithium hydroxide charges by raising the maximum allowable CO_2 content.	-9
Combining AiResearch components.	-7
Addition of radiator controller.	8
Simplified ECS water management and cooling system.	-11
Addition of O_2 surge tank instrumentation (NASA requirement per letter 9569 MA. dated July 23. 1963).	2
EARTH LANDING SYSTEM	(+18)
Addition of second drogue chute installation.	43
Main parachute yoke installation.	-25
LEM INTEGRATION	(+166)
Modify structure to incorporate mating and locking capabilities and to strengthen hatch for impact loads.	150
Add rendezvous beacon radar installation as an aid during the rendezvous phase.	16
SCIENTIFIC EQUIPMENT	(-170)
Reduce scientific equipment to be consistent with that carried in the LEM.	-170
TOTAL POTENTIAL CHANGES, COMMAND MODULE	-308

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

SERVICE MODULE

STRUCTURE	(-40)
Add provisions for nitrogen purging of the Service Module to prevent accidental explosion on the pad.	+15
Replace aluminum honeycomb sandwich in aft heat shield with stiffened fiberglas sheet.	-55
REACTION CONTROL SYSTEM	(+35)
Increase system for incorporation of provisions for RCS propellant quantity indication.	+35
ELECTRICAL POWER	(-356)
Revise the Supercritical Gas Storage System, based on co-ordination with the subcontractor (Beech Aircraft), to include the following changes:	-41
Reduction of insulation preloading from 2 to $\frac{1}{2}$ psi, H_2 tank.	-7
Aluminum skirt for H_2 tank in lieu of titanium.	-3
Fan heaters in lieu of electrofilm heaters cryrogenic system.	-20
Signal conditioners - redirected design-cryrogenic system.	-3
Sculpturing material on complete system.	-13
Reduction in titanium stress allowable.	+5
Reduce H_2 for 8 day mission in lieu of 14 day.	-12
Reduce O_2 for 8 day mission in lieu of 14 day.	-280
Decrease in Fuel Cell Power System, based on Pratt & Whitney's weight report reflecting the following:	-38
Compact Secondary Regenerator	-7
Unitized Gas Manifolds	-6
Close control of electrode filling techniques	-10
Thinner electrode spacing	-15
Additional radiator panels in bays I and IV per fuel cell requirements.	+15

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

SERVICE MODULE

MAIN PROPULSION	(-12)
Redesign main propellant internal tank supports for a reduced gauge.	-12
TOTAL POTENTIAL WEIGHT CHANGES - SERVICE MODULE	-373

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

SUMMARY

ITEM		CURRENT WEIGHT 9-1-63
WEIGHT EMPTY		8056
Structure	4567	
Crew Systems	331	
Communications	368	
Instrumentation	193	
Controls & Displays	286	
Guidance & Navigation	425	
Stabilization & Control	237	
Reaction Control	328	
Electrical Power	431	
Environmental Control	292	
Earth Landing	598	
USEFUL LOAD		1594
Crew Systems	911	
Reaction Control	270	
Environmental Control	163	
Scientific Payload	250	
GROSS WEIGHT		9650

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DETAIL WEIGHT STATEMENT
COMMAND MODULE
STRUCTURE

ITEM		CURRENT WEIGHT 9-1-63
STRUCTURE		
Basic Body Structure		(1040)
Forward Section		181
Honeycomb	56	
Frames, Rings and Hatches	57	
Fittings and Attachments	68	
Center Section		666
Honeycomb Panels	210	
Longerons, Frames and Rings	263	
Window and Hatches	105	
Fittings and Attachments	88	
Aft Section		193
Honeycomb Panel	116	
Ring	77	
Secondary Structure		(566)
RH Equipment Bay and Coldplates		74
LH Equipment Bay		86
Fwd. LH Equipment Bay		20
Fwd. RH Equipment Bay and Coldplates		20
Main Display Panel and Coldplates		65
Lower Equipment Bay and Coldplates		198
Aft Equipment Bay		44
Crew Area		20
Heat Shield Equipment Area		39
Heat Shield Substructure		(1467)
Forward Section		214
Honeycomb Panels	108	
Frames and Rings	31	
Fittings and Mechanism	50	
Strake	25	
Center Section		727
Honeycomb Panels	244	
Frames and Rings	109	
Doors and Covers	190	
Fittings, Mechanism and Attachments	130	
Strake	54	
Aft Section		526
Honeycomb Panels	358	
Frames and Rings	47	
Fittings and Attachments	81	
Toroidal Assembly	40	
Ablation Material		(1277)
Forward Section		139
Center Section		540
Aft Section		598
Insulation		(195)
Separation Provisions and Attachments		(22)
TOTAL STRUCTURE		4567

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

CREW SYSTEMS

ITEM	CURRENT WEIGHT 9-1-63
CREW SYSTEMS	
Crew Couch Support and Restraint System	30.0
Waste Management	25.9
Lighting Equipment	10.3
Egress Accessories - Hatch	3.0
Case Assembly - Map and Manual	2.0
Structural Seats and Supports	258.0
Shelf Assy. - Work/Food Preparation	1.8
TOTAL CREW SYSTEMS	331.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

COMMUNICATIONS

ITEM	CURRENT WEIGHT 8-1-63
COMMUNICATIONS	
Lower Bay	(239.1)
C-Band Transponder	20.8
Unified S-Band	25.0
S-Band Power Amplifier	20.5
VHF FM Transmitter/HF Transceiver	15.9
VHF AM Trans. -Rec/VHF Rec. Bea.	14.0
Multiplexer	11.0
Spares	19.0
Signal Conditioner	32.8
Recorder	25.4
Audio Center	8.0
Premodulation Processor	11.2
Central Timing Equipment	8.0
Up Data Link and Provisions	25.0
VHF-HF Diplexer	1.7
VHF-UHF Diplexer	.8
Remote Equipment	(33.9)
VHF-HR Recovery Antenna & Transmission	9.6
C-Band Antenna & Transmission	9.8
VHF Scimitar Antenna and Transmission	6.8
2-KMC Scimitar Antenna and Transmission and Switches	4.9
2-KMC High Gain Antenna and Transmission	2.8
Electrical Provisions	(95.0)
Electrical Wiring	90.0
Data Distribution Panel	5.0
TOTAL COMMUNICATIONS	368.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

INSTRUMENTATION

ITEM	CURRENT WEIGHT 9-1-63
INSTRUMENTATION	
Lower Equipment Bay	(58.0)
PCM Unit No. 1	26.2
PCM Unit No. 2	20.8
Nuclear Radiation Detection Equipment	11.0
Remote Equipment	(46.0)
Sensors	35.0
Nuclear Radiation Detection Provisions	6.0
TV Camera	5.0
Right Hand Bay Forward	(49.0)
Inflight Test System	
Comparators and Power Supply	34.5
Lamps	4.0
Switches	1.4
Meter	1.0
Chassis	8.1
Electrical Provisions	(40.0)
Inflight Test Electrical Provisions	36.1
Data Distribution Panel	3.9
TOTAL INSTRUMENTATION	193.0

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DETAIL WEIGHT STATEMENT
COMMAND MODULE
CONTROLS AND DISPLAYS

ITEM	CURRENT WEIGHT 9-1-63
MAIN DISPLAY PANEL	
Main Display Panel Control Station	(53.2)
SCS Mode Select	6.1
Delta Velocity	3.9
Flight Director Attitude Indicator	11.9
Attitide Set and Gimbal Position Display	7.6
Entry Monitoring Indicator	15.0
Launch Vehicle Emergency Detection System C-1	3.9
Master Caution and Abort Lt.	.3
IFTS Switch	.1
Barometric Indicator	1.8
Event Timer	1.5
Mounting Panels	1.1
Main Display Panel Center Station	(64.2)
Audio Panel	1.7
Abort Light	.2
Reaction Control	9.5
GMT Readout	5.0
ECS Gages and Controls	7.2
Crew Safety Controls	1.6
High Gain Antenna Control	3.0
G & N Computer Keyboard	15.0
Radiation Displays	3.0
Cryogenic	6.4
Caution and Warning Display	6.1
Mounting Panels	5.5
Main Display Panel System Management Station	(28.4)
Communications Control Panel	4.8
Master Caution Lights	.1
Power Distribution	6.7
Fuel Cells Controls	4.4
Service Propulsion	8.1
IFTS Switch	.1
Oxygen Warning	.1
Mounting Panels	4.1
Main Display Panel RH Console	(9.5)
Bus Switches	5.0
Audio Panel	1.7
Lighting Control	1.1
Mounting Panels	1.7
Main Display Panel LH Console	(6.7)
Mission Sequence Controls	.9
Lighting Control	1.1
Audio Panel	1.7
SCS Power Control	1.3
Mounting Panels	1.7
TOTAL MAIN DISPLAY PANEL (To be brought forward) SID 62-99-19	162.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

CONTROLS AND DISPLAYS

ITEM		CURRENT WEIGHT 9-1-63
REMOTE EQUIPMENT		
Lower Equipment Bay		(50.4)
Lighting Control Panel		1.2
G & N Controls and Displays		49.2
Map and Data Viewer	8.5	
Display and Control - Navigation	25.7	
Display and Control - Computer	15.0	
Left Hand Forward Equipment Bay		(1.8)
Clock		.8
Event Timer		.8
Mounting Panel		.2
Crew Area Controls		(24.6)
Manual Control - Rotation		14.4
Manual Control - Translational		10.2
Caution and Warning		(16.5)
Detector		14.0
Spares		2.5
Electrical Provisions		(30.7)
Electrical Wiring		29.0
SCS/G & N Display Junction Box		1.7
TOTAL REMOTE EQUIPMENT		124.0
TOTAL MAIN DISPLAY PANEL		162.0
TOTAL CONTROLS AND DISPLAYS		286.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

GUIDANCE & NAVIGATION

ITEM	CURRENT WEIGHT 9-1-63
GUIDANCE AND NAVIGATION	
Lower Equipment Bay	
Inertial Platform	59.0
Sextant	12.0
Telescope - Scanning	9.0
Navigation Base	27.2
Computer	74.0
Power Servo Assy	54.7
Coupling Display Unit	16.5
Junction Box	12.2
Cabling - MIT	35.0
Cabling - NAA	16.5
Spares	62.0
Optical Base	21.0
Eye Pieces	3.8
Bellows and Adapter	12.6
Loose Stored Items	9.5
TOTAL GUIDANCE AND NAVIGATION	425.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

STABILIZATION AND CONTROL

ITEM	CURRENT WEIGHT 9-1-63
STABILIZATION AND CONTROL	
Lower Equipment Bay	(219.0)
Rate Gyro Package	7.1
Body Mounted Gyro Package	12.1
Electronic Control Package - Pitch	35.8
Electronic Control Package - Roll	34.7
Electronic Control Package - Yaw	35.9
Electronic Control Package - Auxiliary	34.4
Display/BMAG ECA Package	44.5
Spare Gyro - BMAG (2)	2.0
Spare Gyro - Rate	.5
Spare Plug-in Module	12.0
Electrical Provisions	(18.0)
Wiring, etc.	16.0
SCS Power Junction Box	2.0
TOTAL STABILIZATION AND CONTROL	237.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

REACTION CONTROL SYSTEM

ITEM		CURRENT WEIGHT 9-1-63
REACTION CONTROL SYSTEM		
Propellant Systems		(74.6)
Oxidizer System		37.3
Tanks & Expulsion Devices	15.1	
Plumbing, Fittings & Insulation	11.4	
Valves & Regulators	10.3	
Sensors	.5	
Fuel System		37.3
Tanks & Expulsion Devices	15.1	
Plumbing, Fittings & Insulation	11.4	
Valves & Regulators	10.3	
Sensors	.5	
Pressure System		(55.4)
Tanks (4500 psi)		9.5
Plumbing, Fittings & Insulation		4.8
Valves & Regulators		38.6
Sensors		2.5
Engine System		(138.0)
Engines		96.0
Nozzle Extension		42.0
Electrical Provisions		(23.0)
Dumping System		(32.0)
Valves & Supports		13.0
Controls & Electrical Provisions		12.0
Plumbing & Fittings		5.0
Miscellaneous		2.0
Access		(5.0)
TOTAL REACTION CONTROL SYSTEM		328.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 8-1-63
ELECTRICAL POWER	
Energy Source	(64.0)
Battery - Re-entry (2)	36.0
Battery - Post Landing (1)	18.0
Battery - Pyrotechnic - Installation	10.0
Power Conversion	(117.0)
Inverter (3) & Control	111.0
Battery Charger & Controls	5.0
PLSS Battery Charging System	1.0
Power Distribution & Control	(92.4)
D-C Power Panel Assy	8.6
A-C Power Box Assy	11.1
Battery Circuit Breaker Panel	1.0
Lower Equipment Bay Panel	5.1
Terminal Distribution Panel (Bus)	9.0
Circuit Breaker Panel	4.0
Electrical Transmission (Wiring, Connectors, Cond., Sup.)	34.6
Ground Power Provisions	6.0
Power Control Panel Connectors	3.0
Installation Provisions	10.0
Electrical Common Utility	(157.6)
Electrical Transmission (Wiring, Conn., Cond., & Sup.)	76.7
Right Hand Circuit Breaker Panel	13.0
Left Hand Circuit Breaker Panel	5.4
Lighting	5.0
Adapter Separation System	5.0
LES Separation System	3.5
S/M Pyrotechnic Initiation	3.0
Circuit Utilization Package	12.8
Sequencer	20.0
Installation Provisions	13.2
TOTAL ELECTRICAL POWER	431.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 9-1-63
ENVIRONMENTAL CONTROL SYSTEM	
Pressure Suit Circuit	(89.6)
Subcontractor Compressor, Heat Exchg., Val. & Cont.	74.8
Ducting, Conn., Clamps, etc.	12.8
CO_2 Sensor	2.0
Water-Glycol Circuit	(58.9)
Subcontractor Res., Evaporator, Pump, Val. & Cont.	28.0
Water-Glycol	18.4
Plumbing, etc.	12.5
Pressure & Temp. Control	(18.8)
Subcontractor Heat Exchg., Blower, Val. & Cont.	18.0
Ducting	0.8
Oxygen Supply System	(15.3)
Subcontractor Entry O_2 Sys., Val. & Cont.	5.0
Plumbing	4.0
Oxygen Surge Tank	6.3
Water Supply System	(39.3)
Subcontractor Potable & Waste Tanks & Freon Tank	27.7
Plumbing	11.6
Subcontractor Common Items	(32.2)
Brackets, Plumbing, Elect. Wiring	12.3
Instrumentation	15.8
Radio Noise Filter Spec. Allowance	4.1
Supports	(13.3)
Electrical Provisions	(21.0)
Manual Controls - Push Pull	(3.6)
TOTAL ENVIRONMENTAL CONTROL SYSTEM	292.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

EARTH LANDING SYSTEM

ITEM	CURRENT WEIGHT 9-1-63
EARTH LANDING SYSTEM	
Parachute System	(560.9)
Drogue Chute System	35.5
Main Cluster	449.0
Disconnect Main Cluster	2.7
Pilot Chute System	29.3
Sequence Control	11.8
Attach Provisions	32.6
Location Aids	(10.0)
Forward Heat Shield Release System	(17.1)
Drogue Disconnect Installation	(5.0)
Electrical Pyrotechnic Initiation Provisions	(5.0)
TOTAL EARTH LANDING SYSTEM	598.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ITEM	USEFUL LOAD		CURRENT WEIGHT 9-1-63
CREW SYSTEMS			(911.0)
Crew (3) (50, 70, 90 Percentile)			528.0
Pressure Garment Assy (3) (NASA)			90.0
Food			75.0
Food Containers			15.0
Personal Hygiene Equipment			15.3
Biomedical Instrumentation (NASA)			2.0
Medical Equipment			15.3
Waste Management			6.3
Personal Radiation Dosimeter (NASA)			14.8
Shoe Straps			2.0
Garments - Constant Wear (NASA)			9.0
Hose Assembly-Umbilical			17.9
Hose Assembly-Recharging Backpack			2.8
Belt Assy In-flight Maintenance, Crewman			1.0
Map & Maintenance Manual			4.0
Log Book Assy			1.0
Lap Board Assy			2.0
Tool Set In-flight Maintenance			1.0
Portable Life Support System (NASA)			43.0
Personal Communications			3.0
Mouthpiece - Food, Personal			2.0
Delivery Assy - Water, Personal			1.5
Provision Assy - Crewman Survival (Collective)			56.1
Light Assembly - Portable			3.0
REACTION CONTROL			(270.0)
RCS Propellant			269.0
Usable		225.0	
Residual		44.0	
Trapped - System	30.8		
Mixture Ratio	2.7		
Expulsion Efficiency	7.8		
Loading Tolerance	2.7		
RCS Helium			1.0
ENVIRONMENTAL CONTROL			(163.0)
Lithium Hydroxide			112.0
Activated Charcoal			4.0
Containers for LiOH & Charcoal			12.5
Oxygen - Re-entry			3.7
Freon			10.0
Water-Earth Orbit Cooling & Drinking			4.0
Water-Boost Cooling			4.0
Water-Emergency Re-Entry Cooling			6.0
Water-PLSS Initiated Charge			6.8
SCIENTIFIC PAYLOAD			(250.0)
TOTAL COMMAND MODULE USEFUL LOAD			1594.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

SUMMARY

ITEM		CURRENT WEIGHT 9-1-63
WEIGHT EMPTY		7450
Structure	2265	
Electronics	177	
Reaction Control	580	
Electrical Power	1319	
Environmental Control	87	
Propulsion	3022	
USEFUL LOAD		2230
Reaction Control	838	
Electrical Power	503	
Environmental Control	208	
Propulsion	681	
BURNOUT WEIGHT		9680
MAIN PROPELLANT		37125
GROSS WEIGHT		46805

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

STRUCTURE

ITEM	CURRENT WEIGHT 9-1-63
STRUCTURE	
Basic Body Structure	(1644)
Honeycomb Panels - Shell	762
Radial Beams	380
Internal Structure and Eng. Compt. Closeout	43
Forward Bulkhead	155
Aft Bulkhead	304
Secondary Structure	(209)
Tank Support Shelf	33
Engine Support	41
Antenna Support	30
Heat Shields	105
Insulation	(253)
Separation Provisions and Attach	(16)
Fairing	(143)
TOTAL STRUCTURE	2265
	253
	2018

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRONIC SUBSYSTEM

ITEM		CURRENT WEIGHT 9-1-63
ELECTRONICS SUBSYSTEM		
Communications		(48.0)
High Gain Antenna		29.0
Antenna	12.2	
Gimbals	12.0	
Earth Sensor	4.8	
Antenna Boom		7.0
Antenna Locking Provisions		3.0
Coax		5.0
Coax Connectors		1.0
Supports		1.0
Wiring		2.0
Instrumentation		(129.0)
Sensors		30.0
Electrical Provisions		94.0
Supports		5.0
TOTAL ELECTRONICS SUBSYSTEMS		177.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

REACTION CONTROL

ITEM		CURRENT WEIGHT 9-1-63
REACTION CONTROL SYSTEM		
Propellant Systems		(161.4)
Oxidizer System		80.5
Tanks & Expulsion Devices	28.8	
Plumbing, Fittings & Insulation	8.5	
Valves & Regulators	12.0	
Sensors	3.0	
Supports	18.2	
Quantity Gaging	10.0	
Fuel System		80.9
Tanks & Expulsion Devices	29.2	
Plumbing, Fittings & Insulation	8.5	
Valves & Regulators	12.0	
Sensors	3.0	
Supports	18.2	
Quantity Gaging	10.0	
Pressure System		(128.0)
Tanks (4500 psi)		19.0
Plumbing, Fittings & Insulation		6.0
Valves & Regulators		76.0
Sensors		7.0
Supports		20.0
Engine System		(150.4)
Engines		70.4
Reflectors & Insulation		80.0
Structural Provisions		(80.0)
Electrical Provisions		(60.2)
TOTAL REACTION CONTROL SYSTEM		580.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 9-1-63
ELECTRICAL POWER	
Fuel Cell Power System	(1148.2)
Fuel Cell Power Pack (Incl. Mount Instrumentation)	753.0
Intermodular - Radiator Plumbing	16.0
Fuel Cell Module Mount Attach	2.0
Fuel Cell H_2 System	
Subcontractor Components	138.8
Plumbing and Valves	3.0
Fuel Cell and ECS O_2 System	
Subcontractor Components	167.9
Plumbing and Valves and Supports	22.0
Water Glycol - Fuel Cell Heat Transfer System	7.0
Elect. Wiring - Supercritical Gas	10.0
Space Radiator (Outer Skin)	24.7
Fuel Cell Module Stabilization Webs	3.8
Power Distribution	(79.1)
Electrical Transmission	40.0
Power Distribution Box	39.1
Electrical Common Utility	(91.7)
Electrical Transmission	47.8
Sequencer	8.0
Adapter Separation System	7.0
C/M to S/M Separation System	5.0
Pyrotechnic Initiation	12.0
Provisions	11.9
TOTAL ELECTRICAL POWER	1319.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 9-1-63
ENVIRONMENTAL CONTROL SYSTEM	
Water-Glycol Circuit	(75.0)
Subcontractor Valves & Controls	5.6
Plumbing and Hardware	22.1
Water - Glycol	10.0
Space Radiator (Outer Skin)	37.3
Water Supply System	(7.1)
Subcontractor Valves & Controls	.1
Plumbing and Hardware	7.0
Oxygen Supply System	(3.0)
Plumbing and Supports	3.0
Common Items	(1.9)
Supports	1.9
TOTAL ENVIRONMENTAL CONTROL SYSTEM	87.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

MAIN PROPULSION

ITEM		CURRENT WEIGHT 9-1-63
MAIN PROPULSION		
Propellant Systems		(1350.0)
Oxidizer System		753.3
Tanks & Doors	551.0	
Skirts	59.8	
Plumbing, Fittings & Insulation	53.0	
Valves	4.5	
Quantity Indication	25.5	
Mixture Ratio Control	14.0	
Supports - Plumbing & Equipment	45.5	
Fuel System		596.7
Tanks & Doors	458.0	
Skirts	33.2	
Plumbing, Fittings & Insulation	42.0	
Valves	4.5	
Quantity Indication	25.5	
Supports - Plumbing & Equipment	33.5	
Pressure System		(915.0)
Tanks (4400 psi)		774.0
Tank Supports		30.0
Plumbing, Fittings & Insulation		24.0
Valves, Regulators & Heat Exchanger		49.0
Supports - Plumbing & Equipment		38.0
Engine System		(715.0)
Engine		690.0
Closeouts - Throat to S/M		25.0
Electrical Provisions		(42.0)
TOTAL MAIN PROPULSION SYSTEM		3022.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

USEFUL LOAD

ITEM			CURRENT WEIGHT 9-1-63
REACTION CONTROL			(838.0)
RCS Propellant			835.0
Usable		790.0	
Residual		45.0	
Trapped System	4.0		
Mixture Ratio	9.0		
Expulsion Efficiency	24.0		
Loading Tolerance	8.0		
RCS Helium			3.0
ELECTRICAL POWER (Normal Mission)			(503.0)
Hydrogen - Supercritical Gas			58.5
Usable (Electrochemical Incl. Tolerance)		46.0	
Unusable (Residual & Instrument Error)		3.2	
Emergency Provisions		4.7	
Expended (Leakage & Purge)		4.6	
Oxygen - Supercritical Gas			444.5
Usable (Electrochemical Incl. Tolerance)		377.0	
Unusable (Residual & Instrument Error)		17.5	
Emergency Provisions		44.0	
Expended (Leakage & Purge)		6.0	
ENVIRONMENTAL CONTROL (Normal Mission)			(208.0)
Oxygen - Supercritical Gas			208.0
Usable (Metabolic)		76.5	
Unusable (Residual & Instrument Error)		9.1	
Emergency Provisions		25.3	
Expended (Leakage, LEM, PLSS, Repress.)		97.1	
PROPULSION			(681.0)
Main Propulsion Helium			99.0
Main Propellant Residuals			582.0
Trapped - System		225.0	
Trapped - Engine		67.0	
Mixture Ratio Tolerance		100.0	
Loading Tolerance		190.0	
TOTAL USEFUL LOAD (Less Main Propellant)			2230.0

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DETAIL WEIGHT STATEMENT

LAUNCH ESCAPE SYSTEM

SUMMARY

ITEM	CURRENT WEIGHT 9-1-63
LAUNCH ESCAPE SYSTEM	
Structure	(1011)
Tower Assy	302
Escape Motor Skirt	229
Pitch Motor Structure	157
Nose Cone and Ballast Support	106
Attaching Parts	25
Tower Insulation	182
Skirt Insulation	10
Ballast	(253)
Propulsion	(5345)
Escape Motor	4764
Jettison Motor	434
Jettison Motor Skirt	92
Pitch Control Motor	55
Electrical Power	(41)
TOTAL LAUNCH ESCAPE SYSTEM	6650

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DETAIL WEIGHT STATEMENT

ADAPTER

SUMMARY

ITEM	CURRENT WEIGHT 9-1-63
ADAPTER	
Structure	(3070)
Panels	2470
Frames	200
Thermal Insulation	400
Electrical Power	(80)
Separation System	(250)
TOTAL ADAPTER	3400